ACTUATION MECHANISM FOR RECLINING CHAIR

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally to reclining chairs, and more particularly to a power-assisted actuation mechanism for positioning a leg rest assembly between extended and retracted positions.

[0002] The integrated or "knock down" construction of a reclining chair utilizes unique fabrication and assembly techniques which effectively result in increased production efficiency and cost savings while concomitantly producing a high quality article of furniture. In general, the construction of these integrated reclining chairs is such that a pre-assembled actuation mechanism is integrated into pre-upholstered frame components which, when assembled, are rigidly interconnected to define a "box-like" chair frame. The pre-assembled actuation mechanism includes a drive rod and a front support shaft which are supported by and suspended between left and right side frame assemblies. Front and rear frame rail members interconnect the left and right side frame assemblies to define a "unitized" and rigid box-like chair frame.

[0003] There have also been recent developments in power-assisted chairs which include a motor-operated drive mechanism for permitting a seated occupant to actuate the leg rest assembly, to tilt the chair frame relative to the base assembly, and/or to recline the seat assembly between an upright and fully reclined position. Power-assisted chairs have, in the past, typically been targeted for very specific applications, such as to aid those persons needing assistance

entering/exiting and operating the chair. In addition, persons not specifically needing assistance to operate the reclining chair find power features such as a power-assisted leg rest assembly to be a desirable convenience. Thus, there is a need for a reclining chair which combines the improved structure of a unibody chair frame with a power-assisted actuation mechanism, thereby providing a high-quality, affordable article of furniture.

SUMMARY OF THE INVENTION

[0004] In accordance with the principles of the present invention, a reclining chair having an actuation mechanism and a power-assisted drive mechanism is disclosed. The present invention provides a reclining chair having a motor-driven drive rod which can be simply and efficiently assembled so as to significantly reduce its overall complexity, weight, and cost, while providing improved operation and comfort. The present invention further provides a leg rest assembly operably coupled to the motor-driven drive rod when rotated in a first direction but which may be uncoupled from the motor-driven drive rod when rotated in a second direction.

[0005] In a preferred embodiment of the present invention, the reclining chair includes a pair of side assemblies interconnected at a rear portion by a rear frame rail and at a forward portion by a front frame rail. An actuation mechanism including a drive rod and a front support rod is suspended within the chair frame and operably coupled to a leg rest assembly having an pantograph linkage mechanism detachably coupled to the support shaft. The drive rod extends through a drive motor for selectively rotating the drive rod to extend the

leg rest assembly. A pantograph linkage extends and retracts the leg rest in response to rotation of the drive rod by the drive motor. A drive link rotatably connected to the drive rod engages a follower link of the pantograph linkage to extend the leg rest assembly. A return spring mechanism is interconnected between the pantograph linkage and the chair frame for biasing the pantograph linkage towards the retracted position. The drive link is configured to disengage the follower link if retraction of the leg rest is obstructed, thereby uncoupling the pantograph linkage for the motor-driven drive rod.

[0006] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0008] Figure 1 is an partial exploded perspective view of a reclining chair incorporating the actuation mechanism of the present invention;

[0009] Figure 2 is an assembled perspective view of the actuation mechanism shown in Figure 1;

[0010] Figure 3 is a partially exploded perspective view of a portion of the actuation mechanism shown in Figure 2;

[0011] Figure 4 is a detail of the drive link and follower link;

[0012] Figure 5 is a side view illustrating a portion of the leg rest assembly in a retracted position;

[0013] Figure 6 is a side view similar to Figure 5 illustrating the leg rest assembly in an extended position; and

[0014] Figure 7 is a side view similar to Figure 5 illustrating the leg rest assembly in an obstructed state with the drive link disengaged from the follower link.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] The following description of the preferred embodiment is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0016] In accordance with the teaching of the present invention, an actuation mechanism for use in a reclining chair is disclosed. As used herein, the term "chair" is used broadly to encompass single and multi-person articles of furniture (i.e., chairs, sofas or loveseats). The present invention is readily adaptable to a "knock down" method of assembly in which the actuation mechanism is a pre-assembled and "integrated" component of the reclining chair. As presently preferred, all of the chair frame components are individually fabricated or subassembled to include the requisite brackets, springs, padding and upholstery in an "off line" batch-type basis. Subsequently, these

preassembled frame components are modularly assembled for totally integrating the actuating mechanism therein.

[0017] The pre-assembled actuation mechanism is suspended from the chair frame components so as to provide precise mechanical alignment and superior structural rigidity while employing a highly efficient fabrication and assembly process. As presently preferred, the reclining chair may be capable of a variety of relative motions, namely independent recline of a seat back relative to a seat member, movement of a leg rest assembly between retracted and extended positions, and relative motion between the chair frame and the base assembly such as rocking, tilting, gliding and translating. Moreover, a full range of independent reclining movement of the seat back relative to the seat member is possible regardless of the operative position of the leg rest assembly between the retracted and extended positions. As used herein, the term "reclining" is used broadly to encompass any of such relative motions alone or in combination.

[0018] With particular reference now to the drawings, the functional and structural aspects of the present invention will now be described. Figure 1 illustrates the present invention incorporated into reclining rocking chair 10. Reclining rocking chair 10 is substantially similar in function and structure to the chairs illustrated and disclosed in U.S. Patent No. 5,806,921 issued on September 15, 1998 which is commonly owned by the assignee of the present invention, and the disclosure of which is expressly incorporated by reference herein. Accordingly, only those aspects of reclining rocking chair 10 which relate to the present invention will be described in detail herein. A more detailed

description of the mechanisms associated with this type of chair can be found in the above-identified United States patent incorporated by reference herein.

[0019] Chair 10 includes a chair frame assembly 12 and actuation mechanism 14 operatively suspended from chair frame assembly 12. Chair frame assembly 12 includes side frame assemblies 16 interconnected at a rear edge by rear frame rail member 18 and interconnected at a front edge by front frame member assembly 20 to define a rigid "box-like" chair frame. Actuation mechanism 14 is preassembled to include drive rod 22 and front support shaft 24, both of which are spatially oriented to be precisely located and suspended from side frame assembly 16. Actuation mechanism 14 is shown to support leg rest assembly 26 thereon. More specifically, leg rest assembly 26 includes left and right pantograph linkages 30 both of which are operably associated with drive rod 22 and front support shaft 24 for retracting and extending leg rest board 28 in response to rotation of drive rod 22.

[0020] A drive motor 32 is operably coupled to drive rod 22 to provide a motor-driven drive rod. As presently preferred, drive rod 22 is a one-piece element which extends through the gear set of drive motor 32 at the rearward portion of the drive motor 32. One skill in the art will recognize that the drive motor which is shown within the actuation 14 may be located at other position. In this regard, the drive motor 32 may be located outboard of the location shown. For example, the drive motor 32 may be located within a cavity of one of the side frame assemblies. The front portion of the drive motor 32 is supported by motor brace 34 extending downwardly from front support shaft 24.

The drive mechanism further includes motor control circuitry (not shown) to selectively operate the drive motor through the range of motion without overload thereof. A presently preferred drive motor is the subject of United States Application No. 10/196,851, the disclosure of which is expressly incorporated by reference herein.

[0021] Left and right return spring mechanisms 36, hereinafter referred to singularly, are interconnected between pantograph linkage 30 and rear frame rail member 20. The return spring mechanism 36 includes a support bracket 38 extending from the rear frame rail member 20 and a spring member 40 interposed between the rear frame rail member 20 and the pantograph linkage 30. As presently preferred, spring member 40 is a helical coil spring having a relatively high preload to maintain the leg rest assembly in a retracted position and a relatively low spring rate to minimize the retraction force. Tuning the spring member accordingly minimizes the counter force which the drive motor 32 must overcome to rotate the drive rod, while at the same time minimizes the retraction force imparted on an obstruction of the leg rest assembly.

[0022] The support bracket 38 has a hook portion 42 which extends through a slot 44 formed the rear frame rail member 20 and captures the upper edge 46 thereof. Support bracket 38 is cantilevered from the chair frame 12 and extends downwardly and forwardly from the rear frame rail member 20 and terminates at end 46 which receives one end of spring member 40. The bracket 38 is able to support the spring of the spring member 40 without fasteners securing it to the chair frame assembly 14. As such, the position of the support

bracket 38 relative to the rear frame rail 20 maybe readily adjusted. A stud 50 (as shown in Figure 4) extends from pantograph linkage 30 and receives the other end of spring member 40. Return spring mechanism 36 biases the follower link 64 rearwardly in a counterclockwise direction to urge the pantograph linkage 30 towards the retracted position.

[0023] Front frame member assembly 22 is a multi-piece assembly including front frame board 52 and a pair of front frame brackets 54 extending from opposite lateral ends of front frame board 52. Spacer link 56 is interconnected between drive rod 22, front support shaft 24 and frame board 52 to further integrate actuation mechanism 16 with chair frame assembly 14.

[0024] As best seen in Figures 2 and 3, spacer link 56 includes a rear brace 58 generally supported on drive rod 22 which extends forwardly and upwardly towards the front support shaft 24. Thus, the rear brace 58 of spacer link 56 is supported by drive rod 22, while permitting relative rotation therein. Spacer link 56 also includes a front brace 60 receives front support shaft 24 near the upper end thereof. Front brace 60 extends forwardly and upwardly from front support shaft 24 and is secured to front frame board 52 to provide cantilevered support for the drive rod 22 through the rear brace 58.. Front brace 60 and rear brace 58 of spacer link 56 are secured together with threaded fasteners 62.

[0025] In this way, the front brace 60 and rear brace 58 may be separated to facilitate field service and replacement of the actuation mechanism without further requiring disassembly of the chair frame assembly 14. Specifically, the drive rod 22 along with the drive motor 32 may be uncoupled and removed

from the chair frame 14 without requiring excessive disassembly of the unit. Specifically, the spring members 40 are uncoupled from the follower link 64. Next, the various links – leg rest swing arm 74, follower link 64 and rear brace 58 – are uncoupled from the drive rod 22. Then, the rear brace is uncoupled from the front brace 60 by removing fasteners 62. Lastly, the motor mount 34 is uncoupled from the drive motor 32. At this point the drive rod 22 and drive motor 32 may be moved laterally relative to the remaining component of the chair and removed therefrom. Once the drive motor 32 has been serviced or replaced, the drive rod 22 and drive motor may be re-installed using the reverse sequence described above.

[0026] Right and left hand pantograph linkages 30 hereinafter referred to singularly, are operably suspended from drive rod 22 and front support shaft 24. More specifically, pantograph linkage 30 includes a follower link 64 generally supported on the drive rod 22. The follower link 64 is generally L-shaped having a transverse leg 66 extending generally parallel to drive rod 22 and a longitudinal leg 68 extending perpendicularly away from drive rod 22. A pair of bushings 70 journally support the follower link 64 on the drive rod 22. Thus, drive rod 22 is able to rotate relative to follower link 64.

[0027] Similarly, pantograph linkage 30 is suspended from front support shaft 24 by leg rest swing bracket 72. Leg rest swing bracket 72 receives front support shaft 24 and is releasably secured to leg rest swing arm 74. Threaded fastener 76 releasably secures leg rest swing arm 74 with leg rest swing bracket 74. In this way, the pantograph linkage 30 may be detached from the

drive rod 22 and front support shaft 24 to facilitate field service and replacement thereof without further requiring disassembly of the chair frame assembly 14.

[0028] Pantograph linkage 30 further includes support link 78 pivotally connected at pivot 80 to connection link 82, which is pivotally connected at pivot 84 with front board link 86 which is in turn pivotally connected at pivot 88 with leg rest bracket 90. Similarly, leg rest swing arm 74 is pivotally connected at pivot 92 to rear board link 94 which is turn pivotally connected at pivot 96 to leg rest bracket 90. Leg rest swing arm 74 is pivotally coupled at intermediate pivot 98 with support link 78. Rear board link 94 is pivotally coupled at intermediate pivot 100 with connection link 82. Follower link 64 is pivotally coupled at pivot 102 with support link 78. In this manner, pantograph linkage 30 provides means for articulating the leg rest assembly between a retracted position as illustrated in Figure 5 to a fully extended position as illustrated in Figure 6.

[0029] Drive link 104 is supported on and rotates with drive rod 22. Specifically, drive link 104 receives drive rod 22 and is rotatably coupled thereto. Nylon washer 106 is interposed between drive link 104 and bushing 70. Transverse flange 108 extends laterally outwardly from drive link 104 and is adapted to engage the rearward edge 110 of follower link 64. Accordingly, selective rotation of drive rod 22 in a counter-clockwise direction (as shown in Figs. 5-7) rotates drive link 74 causing transverse flange 108 to engage rear edge 110 of follower link 64, thereby rotating follower link 64 in a counter-clockwise direction. Follower link 64 which acts through pivot 102 moves support link 78. Such movement of support link 78 causes leg rest swing arm 74 to rotate about front

support shaft 24 moving rear board link 94 outwardly and upwardly. In addition, the pivotally coupling of support link 98 with connection link 82 and front board link 86 results in coordinated upward and outward movement of front board link 86. Extension of left and right hand pantograph linkages 30 is simultaneous to position the leg rest assembly from a stored or retracted position shown in Figure 5 to an extended or protracted position as shown in Figure 6.

[0030] As described herein, follower link 64 and drive link 104 function as a clutch mechanism for operably coupling the drive rod 22 with the pantograph linkage 30. Specifically, the clutch mechanism operates in a driven mode for a first direction to couple the drive rod 22 and the pantograph linkage 30 for positioning the leg rest assembly 26 from a retracted position towards an extended position. The clutch mechanism operates in a free-wheeling mode for a second direction to uncouple the drive rod 22 and the pantograph linkage.

[0031] Counter rotation of the drive rod 22 in the clockwise direction (as shown in Figs. 5-7) rotates drive link 104 in a clockwise direction. The rearward biasing force generated by spring member 40 of return spring mechanism 36 rotates follower link 64 in a clockwise direction to maintain contact with transverse flange 108 of drive link 104. In this manner, counter rotation of the drive rod 22 moves the pantograph linkage 30 towards the retracted position. Should the pantograph linkage 30 encounter an obstruction during counter rotation of drive rod 22, counter rotation of follower link 64 stops and transverse flange 108 of the drive link 104 disengages follower link 64 to permit continued counter rotation of drive rod 22. Further retraction of the pantograph linkage 30 is

prevented since the follower link 64 and the leg rest swing arm 76 are journally supported on the actuation mechanism 14. Once the obstruction is removed, follower link 64 counter rotates to engage drive link 104 and the leg rest assembly 26 may be fully retracted by the return spring mechanism 36. In this manner, the motor-assisted drive rod 22 cannot power retract an obstructed leg rest assembly.

[0032] While the foregoing description of the preferred embodiment includes a motor-driven drive rod, one skilled in the art will recognize that a manually-operated drive rod could be employed with the present invention which prevents retraction of an unobstructed leg rest assembly.

[0033] The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.